turing CO_2 by this method has involved additional filtering, cutting into the efficiency and increasing the cost of the technique. But researchers have discovered that a mineral called chabazite—which has a molecular structure resembling a lattice—allows CO_2 to get through while restraining other molecules, thus creating a kind of trapdoor that only captures CO_2. Testing of the chabazite showed that it restricted both methane and nitrogen while letting CO_2 pass through.

"Because the process allows only carbon dioxide molecules to be captured, it will reduce the cost and energy required for separating carbon dioxide," says Paul Webley of the University of Melbourne, a coauthor of the research, which was recently published in the *Journal of the American Chemical Society*.

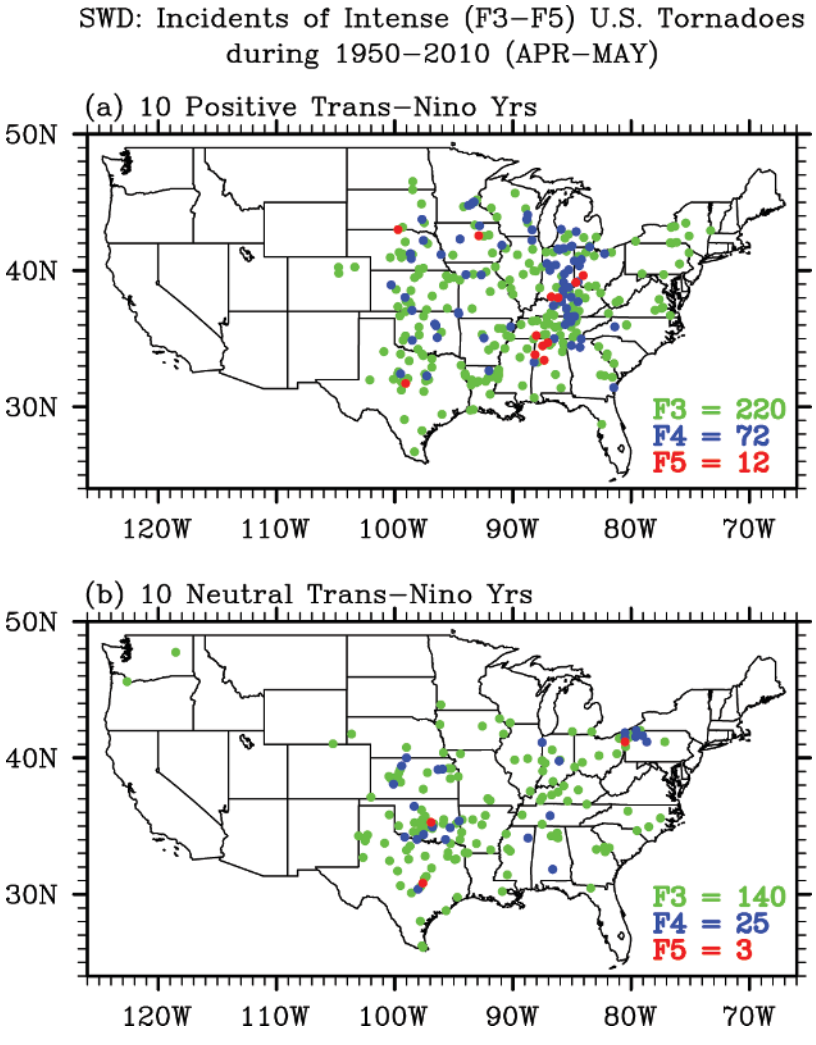
The technique could be useful in both power plants and natural gas extraction. (Sources: RedOrbit.com; Reuters; Central News Agency; University of Melbourne)

PAPERS OF NOTE

Is there an Optimal ENSO Pattern Conducive to U.S. Tornado Outbreaks?

The record-breaking U.S. tornado outbreaks in the spring of 2011 caused unprecedented destruction and raised a question as to whether such destructive events are linked to a specific large-scale climate pattern, which may possibly serve as a predictor before the season begins. Our research shows that a repeating pattern of tropical Pacific sea surface temperature (SST) anomalies appearing most notably during the transitional phase of the El Niño–Southern Oscillation (ENSO) in spring may be one such climate pattern. This pattern, known as the positive-phase Trans-Niño, is characterized by colder-than-normal SSTs in the central tropical Pacific and/or warmer-than-normal SSTs in the eastern tropical Pacific, and often appears when a La Niña is winding down and/or an El Niño is forming in spring.

The study looked at the 10 worst tornado outbreak years in April and May during 1950–2010 and found that 7 of those 10 years—including the top 3—were strongly positive-phase Trans-Niño years. Consistent with this finding, the number of intense tornadoes, those rated as F3 to F5



Incidents of intense U.S. tornadoes in April–May for (a) the top 10 positive-phase Trans-Niño years, and (b) 10 neutral Trans-Niño years during 1950–2010 obtained from the Storm Prediction Center's Severe Weather Database (SWD).

on the Fujita scale, in April and May is nearly doubled from neutral Trans-Niño years to positive-phase Trans-Niño years.

Modeling experiments suggest that the spatial pattern of tropical Pacific SST anomalies associated with the positive-phase Trans-Niño forces a strong and persistent atmospheric teleconnection pattern that increases both the upper-level westerly and lower-level southwesterly flow over the central and eastern United States. These anomalous winds bring more cold and dry upper-level air from the high latitudes and more warm and moist lower-level air from the Gulf of Mexico converging east of the Rockies, and also increase both the lower-tropospheric (0 ~ 6 km) and lower-level (0 ~ 1 km) vertical wind shear values therein, thus providing large-scale atmospheric conditions conducive to intense tornado outbreaks over the central and eastern United States.

A practical implication of the new results is that a seasonal outlook for extreme U.S. tornado outbreaks may be achievable if a seasonal forecasting system has significant skill in predicating the Trans-Niño and associated teleconnections to the United States. However, there remain many fundamental scientific questions and various issues with the tornado database to be addressed before we can achieve such a goal.—Sang-Ki Lee (NOAA), R. Atlas, D. B. Enfield, C. Wang, and H. Liu. "Is There an Optimal ENSO Pattern That Enhances Large-Scale Atmospheric Processes Conducive to Major Tornado Outbreaks in the U.S.?" in a forthcoming issue of the *Journal of Climate*.

CONFERENCE NOTEBOOK

Using Social Media Data to Analyze Debris from the 2011 Tornado Superoutbreak

On 27 April 2011, a historic outbreak of tornadoes in Alabama and parts of neighboring states generated a tremendous amount of debris, as multiple tornadoes struck populated areas. Quilts and metal signs flew 50 miles through the air, while asphalt and SUVs were thrown large fractions of a mile.

Patty Bullion, a resident of Lester, Alabama, created a Facebook page that became a clearinghouse for debris items, particularly photographs, that were found across the Southeast. As a generic example, a photograph found in a yard in, say, Tennessee would be scanned and posted on Bullion's "Pictures and Documents Found after the April 27, 2011, Tornadoes" Facebook page. Then, through the Facebook equivalent of word-of-mouth, someone in a tornado-ravaged town in Mississippi or Alabama would find out about it. A friend or relative of the person in the photograph would place a comment on the Facebook page and the owner of the photograph would be contacted. Addresses would be traded offline by the finder and the owner, and the photograph would be returned. Over 1,700 objects were returned to their tornado-victim owners in this way, a testimony to the power and reach of social media.

At the University of Georgia, we analyzed the information on Bullion's Facebook page and created a database that we then used to perform research on the debris from this outbreak. After careful scrutiny of the information contained in the comments section of the 1,700 lost-and-found items, we employed Google Maps and GIS to reliably determine the takeoff and landing locations of over 900 items. We found that objects traveled as far as 219 miles (353 km), exceeding the previous record of 210 miles (338 km) for the longest documented tornado-debris trajectory. Also, our research revealed a plethora of long-track objects. We concluded that 44 items traveled more than 135 miles (217 km) on 27 April alone; previous research on the subject of tornado debris found just two objects traveled that distance, or farther, in the historical record, which spans 120 years.

We also found that while the majority of debris fell to the left of the average tornado track vector, the longest-traveled objects tended to fall slightly to the right of the vector. Based on numerical trajectory modeling using NOAA's HYSPLIT model, we hypothesize that this is because the longest-traveled debris tend to be the objects that are lofted the highest and are advected by more westerly winds than objects at lower altitudes, given the veering of the synoptic-scale wind with height.

Our research is advancing the study of tornado debris while at the same time expanding the use of social media data into the realm of meteorological research.—John A. Knox (University of